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EXAMINER	
SOLOMON, LISA	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

PTOL-90A (Rev. 04/07)

Office Action Summary	Application No. 10/534,804	Applicant(s) SILVERBROOK, KIA	
	Examiner Lisa M. Solomon	**Art Unit** 2861	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _13 May 2005_.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _1-49_ is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _1-49_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on _13 May 2005_ is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _5/13/05,11/13/06,3/9/07_.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1-2, 4-6, 9, 13, 18-19, 21-23, 26, 30, 35-39, 42, and 46 are rejected under 35 U.S.C. 102(e) as being anticipated by Ramaswami et al. (6,482,574).

In re claim 1, *Ramaswami et al. (574')* teaches an ink jet printhead (26, Fig. 1) comprising: a structure (70, Fig. 7) that is formed by chemical vapor deposition (CVD) [Column 4 lines 24-26, Column 5 lines 54-61]; a plurality of nozzles (32, Fig. 7) incorporated on the structure (70) [Column 5 lines 62-66]; and at least one respective heater element (36, Fig. 8) corresponding to each nozzle [Column 4 lines 1-4, See also Fig. 8], wherein each heater element (36) is arranged for being in thermal contact with a bubble forming liquid [Column 3 lines 29-32], and each heater element (36) is configured to heat at least part of the bubble forming liquid to a temperature above its boiling point to form a gas bubble therein thereby to cause the ejection of a drop of the bubble forming liquid through the nozzle (32) corresponding to that heater element (36) [Column 3 lines 34-38].

In re claim 2, *Ramaswami et al. (574')* teaches the printhead (26) of claim 1 being configured to support the bubble forming liquid in thermal contact with the at least one corresponding heater element (36), and to support the bubble forming liquid adjacent each nozzle (32) [Column 3 lines 24-38].

In re claims 4-6, *Ramaswami et al. (574')* teaches the printhead (26) of claim 1 wherein the CVD is of silicon nitride, the CVD is of silicon dioxide, and the CVD is of oxi-nitride [Column 4 lines 20-24, Column 5 lines 54-58].

In re claim 9, *Ramaswami et al. (574')* teaches The printhead (26) of claim 1 configured to receive a supply of the bubble forming liquid at an ambient temperature, wherein each heater element (36) is configured such that the energy required to be applied thereto to heat said part of the bubble forming liquid to cause the ejection of said drop is less than the energy required to heat a volume of said ejectable liquid equal to the volume of the said drop, from a temperature equal to said ambient temperature to said boiling point [Column 4 lines 29-36].

In re claim 13, *Ramaswami et al. (574')* teaches the printhead of claim 1 comprising a structure (70) being less than 10 microns thick, wherein the nozzles (32) are incorporated in the structure (70) [Column 5 lines 55-61].

In re claim 18, *Ramaswami et al. (574')* teaches a printer system [Column 1 lines 10-13, Column 3 lines 10-14] incorporating a printhead (26, Fig. 1), the printhead (26) comprising: a structure (70, Fig. 7) that is formed by chemical vapor deposition (CVD) [Column 4 lines 24-26, Column 5 lines 54-61]; a plurality of nozzles (32, Fig. 7) incorporated on the structure (70) [Column 5 lines 62-66]; and at least one respective heater element (36, Fig. 8) corresponding to each nozzle [Column 4 lines 1-4, See also Fig. 8], wherein each heater element (36) is arranged for being in thermal contact with a bubble forming liquid [Column 3 lines 29-32], and each heater element (36) is configured to heat at least part of the bubble forming liquid to a temperature above its boiling point to form a gas bubble therein thereby to cause the ejection of a drop of the bubble forming liquid through the nozzle (32) corresponding to that heater element (36) [Column 3 lines 34-38].

In re claim 19, *Ramaswami et al. (574')* teaches the system of claim 18 being configured to support the bubble forming liquid in thermal contact with the at least one corresponding heater element (36), and to support the bubble forming liquid adjacent each nozzle (32) Column 3 lines 24-38].

In re claims 21-23, *Ramaswami et al. (574')* teaches the system of claim 18 wherein the CVD is of silicon nitride, the CVD is of silicon dioxide, and the CVD is of oxi-nitride [Column 4 lines 20-24, Column 5 lines 54-58].

In re claim 26, *Ramaswami et al. (574')* teaches the system of claim 18, wherein the printhead (26) is configured to receive a supply of the bubble forming liquid at an ambient temperature, and wherein each heater element (36) is configured such that the energy required to be applied thereto to heat said part of the bubble forming liquid to cause the ejection of said drop is less than the energy required to heat a volume of said ejectable liquid equal to the volume of the said drop, from a temperature equal to said ambient temperature to said boiling point [Column 4 lines 29-36].

In re claim 30, *Ramaswami et al. (574')* teaches the system of claim 18 comprising a structure (70) being less than 10 microns thick, wherein the nozzles (32) are incorporated in the structure (70) [Column 5 lines 55-61].

In re claim 35, *Ramaswami et al. (574')* teaches a method of ejecting a drop of an ejectable liquid from a printhead (26, Fig. 1), the printhead (26) comprising a plurality of nozzles (32, Fig. 7) and at least one respective heater element (36, Fig. 8) corresponding to each nozzle (32) [Column 3 lines 24-26, Column 4 lines 1-4, See Fig. 8], the method comprising the steps of: providing the printhead (26), including forming a structure (70, Fig. 7) by chemical vapor deposition (CVD), which structure (70) defines nozzle apertures (part where the chamber and the nozzle meet in Fig. 7) each forming part of a respective nozzle (32) [Column 4 lines 24-26, Column 5 line 55-Column 6 line 4]; heating at least one heater element (36) corresponding to a nozzle (32) so as to heat

at least part of a bubble forming liquid which is in thermal contact with the at least one heated heater element (36) to a temperature above the boiling point of the bubble forming liquid [Column 3 lines 31-36]; generating a gas bubble in the bubble forming liquid by said step of heating [Column 3 lines 34-36]; and causing the drop of the bubble forming liquid to be ejected through the nozzle (32) corresponding to the at least one heated heater element (36) by said step of generating a gas bubble [Column 3 lines 24-26; 31-36].

In re claim 36, *Ramaswami et al. (574')* teaches the method of claim 35 comprising, before said step of heating, the steps of: disposing the bubble forming liquid in thermal contact with the heater elements (36) [Column 3 lines 24-38].

In re claims 37-39, *Ramaswami et al. (574')* teaches the method of claim 35 wherein the step of providing the printhead comprises forming the structure by CVD of silicon nitride, CVD of silicon dioxide, and CVD of oxi-nitride [Column 4 lines 20-24, Column 5 lines 54-58].

In re claim 42, *Ramaswami et al. (574')* teaches the method of claim 35, comprising, prior to the step of heating at least one heater element (36), the step of receiving a supply of the bubble forming liquid, at an ambient temperature, to the printhead, wherein the step of heating is effected by applying heat energy to each such heater element (36), wherein said applied heat energy is less than the energy required

to heat a volume of said bubble forming liquid equal to the volume of said drop, from a temperature equal to said ambient temperature to said boiling point[Column 4 lines 29-36].

In re claim 46, *Ramaswami et al. (574')* teaches the method of claim 35 wherein, in the step of providing the printhead (26), the printhead (26) has a structure (70) which is less that 10 microns thick and which incorporates said nozzles (32) [Column 5 lines 55-61].

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 3, 8, 20, 25, and 41 rejected under 35 U.S.C. 103(a) as being unpatentable over Ramaswami et al. (6,482,574) in view of Silverbrook (6,019,457).

In re claim 3, *Ramaswami et al. (574')* teaches the printhead of claim 1 [see rejection above]. However, Ramaswami e al. (574') does not teach the printhead being configured to print on a page and to be a page-width printhead.

Silverbrook (457') teaches the printhead being configured to print on a page and to be a page-width printhead [Column 2 lines 19-22].

It would have been obvious to one of ordinary skill in the art at the time invention was made to provide a page-width printhead configuration that prints on a page as taught by Silverbrook (457') in the printhead of Ramaswami et al. (574') for the purposes of effectively printing an image on the full width of the page [Silverbrook (457') Column 2 lines 20-22].

In re claim 8, *Ramaswami et al. (574')* teaches the printhead of claim 1 [see rejection above]. However, Ramaswami et al. (574') doe not teach wherein each heater element is configured such that an actuation energy of less than 500 nanojoules (nJ) is required to be applied to that heater element to heat that heater element sufficiently to form a said bubble in the bubble forming liquid thereby to cause the ejection of said drop.

Silverbrook (457') teaches wherein each heater element is configured such that an actuation energy of less than 500 nanojoules (nJ) is required to be applied to that heater element to heat that heater element sufficiently to form a said bubble in the bubble forming liquid thereby to cause the ejection of said drop [Column 19 lines 8-10].

It would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the actuation energy required to be applied to a heater element to sufficiently heat the heater element to form a bubble in the bubble forming liquid to cause the ejection of a drop to be less than 500 (nJ) as taught by Silverbrook (457') in the printhead of Ramaswami et al. (574') for the purposes of providing efficient power dissipation in the printhead [Silverbrook (457') Column 18 line 66-67].

In re claim 20, *Ramaswami et al. (574')* teaches the system of claim 18 [see rejection above]. However, Ramaswami e al. (574') does not teach the printhead being configured to print on a page and to be a page-width printhead.

Silverbrook (457') teaches the printhead being configured to print on a page and to be a page-width printhead [Column 2 lines 19-22].

It would have been obvious to one of ordinary skill in the art at the time invention was made to provide a page-width printhead configuration that prints on a page as taught by Silverbrook (457') in the system of Ramaswami et al. (574') for the purposes of effectively printing an image on the full width of the page [Silverbrook (457') Column 2 lines 20-22].

In re claim 25, *Ramaswami et al. (574')* teaches the system of claim 18 [see rejection above]. However, Ramaswami et al. (574') doe not teach wherein each heater element is configured such that an actuation energy of less than 500 nanojoules (nJ) is required to be applied to that heater element to heat that heater element sufficiently to form a said bubble in the bubble forming liquid thereby to cause the ejection of said drop.

Silverbrook (457') teaches wherein each heater element is configured such that an actuation energy of less than 500 nanojoules (nJ) is required to be applied to that

heater element to heat that heater element sufficiently to form a said bubble in the bubble forming liquid thereby to cause the ejection of said drop [Column 19 lines 8-10].

It would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the actuation energy required to be applied to a heater element to sufficiently heat the heater element to form a bubble in the bubble forming liquid to cause the ejection of a drop to be less than 500 (nJ) as taught by Silverbrook (457') in the system of Ramaswami et al. (574') for the purposes of providing efficient power dissipation in the printhead [Silverbrook (457') Column 18 line 66-67].

In re claim 41, *Ramaswami et al. (574')* teaches the method of claim 35 [see rejection above]. However, Ramaswami et al. (574') does not teach wherein the step of heating a heating element having at least one heater element is effected by applying an actuation energy of less than 500 nJ to each heater element to be heated.

Silverbrook (457') teaches the step of heating a heating element have at least one heater is effected by applying an actuation energy of less than 500 (nJ) to each heater element to be heated [Column lines 8-10].

It would be obvious to one of ordinary skill in the art at the time the invention was made to provide a method in which the step of heating a heating element have at least one heater is effected by applying an actuation energy of less than 500 (nJ) to each heater element to be heated as taught by Silverbrook (457') in the method of Ramaswami et al. (574') for the purposes of providing efficient power dissipation in the printhead [Silverbrook (457') Column 18 lines 66-67].

5. Claims 7, 11, 14-15, 17, 24, 28, 31-32, 34, 40, 44, and 47-48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ramaswami et al. (6,482,574) in view of Kubby (5,706,041).

In re claim 7, *Ramaswami et al. (574')* teaches the printhead of claim 1 [see rejection above]. However, Ramaswami et al. (574') does not teach wherein each heater element is in the form of a suspended beam that is suspended over at least a portion of the bubble forming liquid so as to be in thermal contact therewith.

Kubby (041') teaches wherein each heater element is in the form of a suspended beam that is suspended over at least a portion of the bubble forming liquid so as to be in thermal contact therewith [Column 3 lines 25-31; 50-53; 58-61; 64-Column 4 line 4].

It would have been obvious to one of ordinary skill in the art at the time the invention was made to provide each heater element to be in the form of a suspended beam that is suspended over at least a portion of the bubble forming liquid so as to be in thermal contact therewith as taught by Kubby (041') in the printhead of Ramaswami et al. (574') for the purposes of heating the ejectable liquid [Kubby (041') Column 3 line 64-Column 4 line 2].

In re claim 11, *Ramaswami et al. (574')* teaches the printhead of claim 1 [see rejection above]. However, Ramaswami et al. (574') does not teach wherein each heater element has two opposite sides and is configured such that said gas bubble formed by that heater element is formed at both of said sides.

Kubby (041') teaches wherein each heater element has two opposite sides and is configured such that said gas bubble formed by that heater element is formed at both of said sides [Column 4 lines 23-32; 44-50].

It would have been obvious to of ordinary skill in the art at the time the invention was made to provide the heater element to have two opposite sides and configured such that said gas bubble formed by that heater element is formed at both sides as taught by Kubby (041') in the printhead of Ramaswami et al. (574') for the purposes of providing dissipation of heat both above and below the heater element [Kubby (041') Column 4 lines 51-55].

In re claim 14, *Ramaswami et al. (574')* teaches the printhead of claim 1 comprising a plurality of nozzle chambers each corresponding to a respective nozzle [Column 3 lines 24-33], and a plurality of said heater elements being disposed within each chamber [See Fig. 8]. However, Ramaswami et al. (574') does not teach the heater elements within each chamber being formed on different respective layers.

Kubby (041') teaches the heater elements within each chamber being formed on different respective layers [Column 4 lines 23-32; 44-50, See Fig. 4].

It would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the heater elements to be formed on different respective layers as taught by Kubby (041') in the printhead of Ramaswami et al. (574') for the purposes of causing the generation of a larger bubble (heat is dissipated above and

below the suspended beam) whereas the bubble generated by a conventional heating element is smaller, thereby ejecting less ink [Kubby (041') Column 4 lines 59-66].

In re claim 15, *Ramaswam et al. (574')* teaches the printhead of claim 1 [see rejection above]. However, Ramaswami et al. (574') does not teach wherein each heater element is formed of solid material more than 90% of which, by atomic proportion, is constituted by at least one periodic element having an atomic number below 50.

Kubby (041') teaches wherein each heater element is formed of solid material more than 90% of which, by atomic proportion, is constituted by at least one periodic element having an atomic number below 50 [Column 3 lines 58-61, Column 3 lines 35-37; 44-50].

It would have been obvious to one of ordinary skill in the art at the time the invention was made to provide each heater element to be formed of a solid material more than 90% of which, by atomic proportion, is constituted by at least one periodic element having an atomic number below 50 as taught by Kubby (041') in the printhead of Ramaswami et al. (041') for the purposes of improving the overall heat-transference efficiency of the heating element [Kubby (041') Column 5 lines 14-18].

In re claims 17, 34, *Ramaswami et al. (574')* teaches the printhead of claim 1 [see rejection above]. However, Ramaswami et al. (574') does not teach wherein each

heater element is substantially covered by a conformal protective coating, the coating of each heater element having been applied substantially to all sides of the heater element simultaneously such that the coating is seamless.

Kubby (041') teaches wherein each heater element is substantially covered by a conformal protective coating, the coating of each heater element having been applied substantially to all sides of the heater element simultaneously such that the coating is seamless [Column 4 lines 13-22].

It would have been obvious to one of ordinary skill in the art at the time the invention was made to provide each heater to be covered by a conformal protective coating, the coating having been applied substantially to all sides of the heater element simultaneously such that the coating is seamless as taught by Kubby (041') in the printhead of Ramaswami et al. (574') for the purposes of protecting the heater element form corrosion by the ink [Kubby (041') Column 4 lines 15-17].

In re claim 24, *Ramaswami et al. (574')* teaches the system of claim 18 [see rejection above]. However, Ramaswami et al. (574') does not teach wherein each heater element is in the form of a suspended beam that is suspended over at least a portion of the bubble forming liquid so as to be in thermal contact therewith.

Kubby (041') teaches wherein each heater element is in the form of a suspended beam that is suspended over at least a portion of the bubble forming liquid so as to be in thermal contact therewith [Column 3 lines 25-31; 50-53; 58-61; 64-Column 4 line 4].

It would have been obvious to one of ordinary skill in the art at the time the invention was made to provide each heater element to be in the form of a suspended beam that is suspended over at least a portion of the bubble forming liquid so as to be in thermal contact therewith as taught by Kubby (041') in the system of Ramaswami et al. (574') for the purposes of heating the ejectable liquid [Kubby (041') Column 3 line 64-Column 4 line 2].

In re claim 28, *Ramaswami et al. (574')* teaches the system of claim 18 [see rejection above]. However, Ramaswami et al. (574') does not teach wherein each heater element has two opposite sides and is configured such that said gas bubble formed by that heater element is formed at both of said sides.

Kubby (041') teaches wherein each heater element has two opposite sides and is configured such that said gas bubble formed by that heater element is formed at both of said sides [Column 4 lines 23-32; 44-50].

It would have been obvious to of ordinary skill in the art at the time the invention was made to provide the heater element to have two opposite sides and configured such that said gas bubble formed by that heater element is formed at both sides as taught by Kubby (041') in the system of Ramaswami et al. (574') for the purposes of providing dissipation of heat both above and below the heater element [Kubby (041') Column 4 lines 51-55].

In re claim 31, *Ramaswami et al. (574')* teaches the system of claim 18 comprising a plurality of nozzle chambers each corresponding to a respective nozzle [Column 3 lines 24-33], and a plurality of said heater elements being disposed within each chamber [See Fig. 8]. However, Ramaswami et al. (574') does not teach the heater elements within each chamber being formed on different respective layers.

Kubby (041') teaches the heater elements within each chamber being formed on different respective layers [Column 4 lines 23-32; 44-50, See Fig. 4].

It would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the heater elements to be formed on different respective layers as taught by Kubby (041') in the system of Ramaswami et al. (574') for the purposes of causing the generation of a larger bubble (heat is dissipated above and below the suspended beam) whereas the bubble generated by a conventional heating element is smaller, thereby ejecting less ink [Kubby (041') Column 4 lines 59-66].

In re claim 32, *Ramaswami et al. (574')* teaches the system of claim 18 [see rejection above]. However, Ramaswami et al. (574') does not teach wherein each heater element is formed of solid material more than 90% of which, by atomic proportion, is constituted by at least one periodic element having an atomic number below 50.

Kubby (041') teaches wherein each heater element is formed of solid material more than 90% of which, by atomic proportion, is constituted by at least one periodic

element having an atomic number below 50 [Column 3 lines 58-61, Column 3 lines 35-37; 44-50].

It would have been obvious to one of ordinary skill in the art at the time the invention was made to provide each heater element to be formed of a solid material more than 90% of which, by atomic proportion, is constituted by at least one periodic element having an atomic number below 50 as taught by Kubby (041') in the system of Ramaswami et al. (041') for the purposes of improving the overall heat-transference efficiency of the heating element [Kubby (041') Column 5 lines 14-18].

In re claim 40, *Ramaswami et al. (574')* teaches the method of claim 35 [see rejection above]. However, *Ramaswami et al. (574')* does not teach wherein each heater element is in the form of a suspended beam, the method further comprising, prior to the step of heating at least one heater element, the step of disposing the bubble forming liquid such that the heater elements are positioned above, and in thermal contact with, at least a portion of the bubble forming liquid.

Kubby (457') teaches each heater element is in the form of a suspended beam [Column 3 lines 25-31; 50-53; 58-61; 64-Column 4 line 4] and prior to the step of heating at least one heater element, the step of disposing the bubble forming liquid such that the heater elements are positioned above, and in thermal contact with, at least a portion of the bubble forming liquid [Column 5 lines 4-11].

It would have been obvious to one of ordinary skill in the art at the time the invention was made to provide each heater element to be in the form of a suspended

beam and prior to the step of heating at least one heater element, the step of disposing the bubble forming liquid such that the heater elements are positioned above, and in thermal contact with, at least a portion of the bubble forming liquid as taught by Kubby (041') in the method of Ramaswami et al. (574') for the purposes of heating the ejectable liquid [Kubby (041') Column 3 line 64-Column 4 line 2].

In re claim 44, *Ramaswami et al. (574')* teaches the method of claim 35 [see rejection above]. However, Ramaswami et al. (574') does not teach wherein each heater element has two opposite sides and wherein, in the step of generating gas bubble, the bubble is generated at both of said sides of each heated heater element.

Kubby (041') teaches wherein each heater element has two opposite sides and is configured such that said gas bubble formed by that heater element is formed at both of said sides [Column 4 lines 23-32; 44-50].

It would have been obvious to of ordinary skill in the art at the time the invention was made to provide the heater element to have two opposite sides and configured such that said gas bubble formed by that heater element is formed at both sides as taught by Kubby (041') in the method of Ramaswami et al. (574') for the purposes of providing dissipation of heat both above and below the heater element [Kubby (041') Column 4 lines 51-55].

In re claim 47, *Ramaswami et al. (574')* teaches the method of claim 35 wherein the printhead has a plurality of nozzle chambers each chamber corresponding to a respective nozzle and wherein the step of providing the printhead includes forming a plurality of heater elements in each chamber [Column 3 lines 24-33, See Fig. 8]. However, Ramaswami et al. (574') does not teach the heater elements in each chamber are formed on different respective layers to one another.

Kubby (041') teaches the heater elements within each chamber being formed on different respective layers [Column 4 lines 23-32; 44-50, See Fig. 4].

It would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the heater elements to be formed on different respective layers as taught by Kubby (041') in the method of Ramaswami et al. (574') for the purposes of causing the generation of a larger bubble (heat is dissipated above and below the suspended beam) whereas the bubble generated by a conventional heating element is smaller, thereby ejecting less ink [Kubby (041') Column 4 lines 59-66].

In re claim 48, *Ramaswami et al. (574')* teaches the method of claim 35 [see rejection above]. However, Ramaswami et al. (574') does not teach wherein each heater element is formed of solid material more than 90% of which, by atomic proportion, is constituted by at least one periodic element having an atomic number below 50.

Kubby (041') teaches wherein each heater element is formed of solid material more than 90% of which, by atomic proportion, is constituted by at least one periodic element having an atomic number below 50 [Column 3 lines 58-61, Column 3 lines 35-37; 44-50].

It would have been obvious to one of ordinary skill in the art at the time the invention was made to provide each heater element to be formed of a solid material more than 90% of which, by atomic proportion, is constituted by at least one periodic element having an atomic number below 50 as taught by Kubby (041') in the method of Ramaswami et al. (041') for the purposes of improving the overall heat-transference efficiency of the heating element [Kubby (041') Column 5 lines 14-18].

6. Claims 12, 29, and 45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ramaswami et al. (6,482,574) in view of Weber et al. (6,003,977).

In re claim 12, *Ramaswami et al. (574')* teaches the printhead of claim 1 [see rejection above]. However, Ramaswami et al. (574') does not teach wherein the bubble, which each heater element is configured, to form is collapsible and has a point of collapse, and wherein each heater element is configured such that the point of collapse of a bubble formed thereby is spaced from that heater element.

Weber et al. (977') teaches wherein the bubble, which each heater element is configured, to form is collapsible and has a point of collapse, and wherein each heater element is configured such that the point of collapse of a bubble formed thereby is spaced from that heater element [Column 5 line 60-Column 6 line 2].

It would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the bubble generated by each heater element to be collapsible and have a point of collapse and to configure each heater element such that the point of collapse of a bubble generated by the heater element is space from the heater element as taught by Weber et al. (977') in the printhead of Ramaswami et al. (574') for the purposes of minimizing the effects of cavitation [Weber et al. (977') Column 5 lines 49-53].

In re claim 29, *Ramaswami et al. (574')* teaches the system of claim 18 [see rejection above]. However, Ramaswami et al. (574') does not teach wherein the bubble which each heater element is configured to form is collapsible and has a point of collapse, and wherein each heater element is configured such that the point of collapse of a bubble formed thereby is spaced from that heater element.

Weber et al. (977') teaches wherein the bubble, which each heater element is configured, to form is collapsible and has a point of collapse, and wherein each heater element is configured such that the point of collapse of a bubble formed thereby is spaced from that heater element [Column 5 line 60-Column 6 line 2].

It would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the bubble generated by each heater element to be collapsible and have a point of collapse and to configure each heater element such that the point of collapse of a bubble generated by the heater element is space from the

heater element as taught by Weber et al. (977') in the system of Ramaswami et al. (574') for the purposes of minimizing the effects of cavitation [Weber et al. (977') Column 5 lines 49-53].

In re claim 45, *Ramaswami et al. (574')* teaches the method of claim 35 [see rejection above]. However Ramaswami et al. (574') does not teach wherein, in the step of generating gas bubble, the generated bubble is collapsible and has a point of collapse, and is generated such that the point of collapse is spaced from the at least one heated heater element.

Weber et al. (977') teaches the step of generating gas bubble, the generated bubble is collapsible and has a point of collapse, and is generated such that the point of collapse is spaced from the at least one heated heater element [Column 4 lines 29-31, [Column 5 line 60-Column 6 line 2].

It would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the step of generating gas bubble, the generated bubble is collapsible and has a point of collapse, and is generated such that the point of collapse is spaced from the at least one heated heater element as taught by Weber et al. (977') in the method of Ramaswami et al. (574') for the purposes of minimizing the effects of cavitation [Weber et al. (977') Column 5 lines 49-53].

7. Claims 10, 27, and 43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ramaswami et al. (6,482,574) in view of Feinn et al. (6,543,879).

In re claim 10, *Ramswami et al. (574')* teaches the printhead (26, Fig. 1) of claim 1 comprising a substrate (30, Fig. 8) having a substrate surface (top surface of element 30 on Fig. 8), wherein each nozzle (32) has a nozzle aperture (part where elements 34 and 32 meet on Fig. 8) opening through the substrate surface [Column 3 lines 27-31]. However, Ramaswami et al. (574') does not teach wherein the areal density of the nozzles relative to the substrate surface exceeds 10,000 nozzles per square cm of substrate surface.

Feinn et al. (879') teaches the areal density of the nozzles relative to the substrate surface exceeds 10,000 nozzles per square cm of substrate surface [Abstract].

It would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the areal density of the nozzles relative to the substrate surface exceeds 10,000 nozzles per square cm of substrate surface as taught by Feinn et al. (879') in the printhead of Ramaswami et al. (574') for the purposes of accommodating higher printing resolutions and to improve ink drop ejection rate [Feinn et al. (879') Column 1 lines 57-61].

In re claim 27, *Ramswami et al. (574')* teaches the system of claim 18 comprising a substrate (30, Fig. 8) having a substrate surface (top surface of element 30 on Fig. 8),

wherein each nozzle (32) has a nozzle aperture (part where elements 34 and 32 meet on Fig. 8) opening through the substrate surface [Column 3 lines 27-31]. However, Ramaswami et al. (574') does not teach wherein the areal density of the nozzles relative to the substrate surface exceeds 10,000 nozzles per square cm of substrate surface.

Feinn et al. (879') teaches the areal density of the nozzles relative to the substrate surface exceeds 10,000 nozzles per square cm of substrate surface [Abstract].

It would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the areal density of the nozzles relative to the substrate surface exceeds 10,000 nozzles per square cm of substrate surface as taught by Feinn et al. (879') in the system of Ramaswami et al. (574') for the purposes of accommodating higher printing resolutions and to improve ink drop ejection rate [Feinn et al. (879') Column 1 lines 57-61].

In re claim 43, *Ramswami et al. (574')* teaches the method of claim 35 wherein, in the step of providing the printhead (26), the printhead includes a substrate (30, Fig. 8) having a substrate surface (top surface of element 30 on Fig. 8), wherein each nozzle (32) has a nozzle aperture (part where elements 34 and 32 meet on Fig. 8) opening through the substrate surface [Column 3 lines 27-31]. However, Ramaswami et al. (574') does not teach wherein the areal density of the nozzles relative to the substrate surface exceeds 10,000 nozzles per square cm of substrate surface.

Feinn et al. (879') teaches the areal density of the nozzles relative to the substrate surface exceeds 10,000 nozzles per square cm of substrate surface [Abstract].

It would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the areal density of the nozzles relative to the substrate surface exceeds 10,000 nozzles per square cm of substrate surface as taught by Feinn et al. (879') in the method of Ramaswami et al. (574') for the purposes of accommodating higher printing resolutions and to improve ink drop ejection rate [Feinn et al. (879') Column 1 lines 57-61].

8. Claims 16, 33, and 49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ramaswami et al. (6,482,574) in view of Yamashita et al. (5,969,005).

In re claim 16, *Ramaswami et al. (574')* teaches the printhead of claim 1 wherein each heater element includes solid material [Column 3 lines 53-56; 63-67]. However, Ramaswami et al. (574') does not teach each heater element is configured for a mass of less than 10 nanograms of the solid material of that heater element to be heated to a temperature above the boiling point of the bubble forming liquid thereby to heat at least part of the bubble forming liquid to a temperature above said boiling point to cause the ejection of a said drop.

Yamashita et al. (005') teaches each heater element is configured for a mass of less than 10 nanograms of the solid material of that heater element to be heated to a

temperature above the boiling point of the bubble forming liquid thereby to heat at least part of the bubble forming liquid to a temperature above said boiling point to cause the ejection of a said drop [Abstract lines 23-25, Column 30 lines 29-32; 37-40, Column 31 lines 18-22].

It would have been obvious to one of ordinary skill in the art at the time the invention was made to provide each heater element to be configured for a mass of less than 10 nanograms of the solid material of that heater element to be heated to a temperature above the boiling point of the bubble forming liquid thereby to heat at least part of the bubble forming liquid to a temperature above said boiling point to cause the ejection of a said drop as taught by Yamashita et al. (005') in the printhead of Ramaswami et al. (574') for the purposes of improving image quality [Yamashita et al. (005') Column 30 lines 37-38].

In re claim 33, *Ramaswami et al. (574')* teaches the system of claim 18 wherein each heater element includes solid material [Column 3 lines 53-56; 63-67]. However, Ramaswami et al. (574') does not teach each heater element is configured for a mass of less than 10 nanograms of the solid material of that heater element to be heated to a temperature above the boiling point of the bubble forming liquid thereby to heat at least part of the bubble forming liquid to a temperature above said boiling point to cause the ejection of a said drop.

Yamashita et al. (005') teaches each heater element is configured for a mass of less than 10 nanograms of the solid material of that heater element to be heated to a

temperature above the boiling point of the bubble forming liquid thereby to heat at least part of the bubble forming liquid to a temperature above said boiling point to cause the ejection of a said drop [Abstract lines 23-25, Column 30 lines 29-32; 37-40, Column 31 lines 18-22].

It would have been obvious to one of ordinary skill in the art at the time the invention was made to provide each heater element to be configured for a mass of less than 10 nanograms of the solid material of that heater element to be heated to a temperature above the boiling point of the bubble forming liquid thereby to heat at least part of the bubble forming liquid to a temperature above said boiling point to cause the ejection of a said drop as taught by Yamashita et al. (005') in the system of Ramaswami et al. (574') for the purposes of improving image quality [Yamashita et al. (005') Column 30 lines 37-38].

In re claim 49, *Ramaswami et al. (574')* teaches the method of claim 35 wherein each heater element includes solid material [Column 3 lines 53-56; 63-67]. However, Ramaswami et al. (574') does not teach wherein the step of heating at least one heater element includes heating a mass of less than 10 nanograms of the solid material of each such heater element to a temperature above the boiling point of the bubble forming liquid.

Yamashita et al. (005') teaches the step of heating at least one heater element includes heating a mass of less than 10 nanograms of the solid material of each such

heater element to a temperature above the boiling point of the bubble forming liquid [Abstract lines 23-25, Column 30 lines 29-32; 37-40, Column 31 lines 18-22].

It would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the step of heating at least one heater element includes heating a mass of less than 10 nanograms of the solid material of each such heater element to a temperature above the boiling point of the bubble forming liquid as taught by Yamashita et al. (005') in the method of Ramaswami et al. (574') for the purposes of improving image quality [Yamashita et al. (005') Column 30 lines 37-38].

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lisa M. Solomon whose telephone number is (571) 272-1701. The examiner can normally be reached on Monday - Friday from 8:00 am - 4:30 pm. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Luu can be reached on (571) 272-7663. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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